CLAIMS

1. An electron beam exposure apparatus for transferring a pattern onto the surface of a target, comprising:

- a beamlet generator for generating a plurality of electron beamlets;
- a modulation array for receiving said plurality of electron beamlets, comprising a plurality of modulators for modulating the intensity of an electron beamlet;
- a controller, operationally connected to the modulation array, for individually controlling the modulators using control signals;
- an adjustor, connected to each modulator, for individually adjusting the control signal of each modulator;
- a focusing electron optical system comprising an array of electrostatic lenses wherein each lens focuses a corresponding individual beamlet, which is transmitted by said modulation array, to a cross section smaller than 300 nm, and
- a target holder for holding a target with its exposure surface onto which the pattern is to be transferred in the first focal plane of the focusing electron optical system.

2. The electron beam exposure apparatus according to claim 1, furthermore provided with measuring means for measuring the actual position of at least one of said beamlets, and wherein the controller is provided with memory means for storing said actual position and a desired position, a comparator for comparing the desired position and the actual position of said beamlets, and wherein the adjustor is operationally connected to the controller for receiving instructions for adjusting the control signals issued to the modulators to compensate for the measured difference between said desired position and said actual position of said electron beamlets.

3. The electron beam exposure apparatus according to claim 1, wherein the adjustor is operationally connected to the controller for receiving instructions indicating the amount of the adjustments.

4. The electron beam exposure apparatus according to any one of claims 1, wherein the adjustor is adapted for individually adjusting timing of each control signal.

5. The electron beam exposure apparatus according to claim 1, wherein said modulation array comprises:

- a beamlet blanker array comprising a plurality of beamlet blankers for the deflection of a passing electron beamlet,
- a beamlet stop array, having a plurality of apertures aligned with said beamlet blankers of said beamlet blanker array.

6. The electron beam exposure apparatus according to claim 5, wherein the controller is operationally connected to said beamlet blankers.

7. The electron beam exposure apparatus of claim 5, wherein the controller is operationally connected to said beam blankers via said adjustor.

8. The electron beam exposure apparatus according to claim 1, wherein said beamlet generator comprises:

- a source for emitting at least one electron beam,
- at least one beamsplitter for splitting said at least one emitted electron beam into said plurality of electron beamlets.

9. The electron beam exposure apparatus according to claim 8, wherein said beamsplitter comprise a spatial filter, preferably an aperture array.

10. The electron beam exposure apparatus according to claims 8, wherein said beamsplitter comprises a number of aperture arrays in a serial order along the path of the electron beam or plurality of beamlets, the aperture arrays having mutually aligned apertures, each next aperture array along the path from the source to the target having apertures that are smaller than the apertures of the previous aperture array.

11. The electron beam exposure apparatus according to claim 9, wherein the apertures of each aperture array are arranged in a hexagonal structure.

12. The electron beam exposure apparatus according to claim 9, wherein each aperture of the aperture array has an area inversely proportional to the current density based on the beamlet that is transmitted through that same aperture, and/or the aperture sizes in the aperture array are adapted to create a discrete set of predetermined beamlet currents.

13. The electron beam exposure apparatus according to claims 8, wherein said beamsplitter comprises an electrostatic quadrupole lens array.

14. The electron beam exposure apparatus according to any one of the preceding claims, wherein said modulation array comprises a beamlet blanker array comprising a plurality of beamlet blankers for the deflection of a passing electron beamlet and a beamlet stop array, having a plurality of apertures aligned with said beamlet blankers of said beamlet blanker array, said beamlet generator comprises a source for emitting at least one electron beam and at least one beamsplitter for splitting said at least one emitted electron beam into said plurality of electron beamlets, said exposure apparatus further comprising a second electrostatic lens array located between said beamsplitter and said beamlet blanker array to focus said plurality of electron beamlets.

15. The electron beam exposure apparatus according to claim 14, wherein said beamlet blanker array is located in the focal plane of said second electrostatic lens array.

16. The electron beam exposure apparatus according to claim 1, wherein said beamlet generator comprises a thermionic source.

17. The electron beam exposure apparatus according to claim 16, wherein said thermionic source is adapted for operating in the space charge limited regime.

18. The electron beam exposure apparatus according to claim 16, wherein said thermionic source has a spherical cathode surface.

19. The electron beam exposure apparatus according to any one of the claims 17, wherein said beamlet generator comprises at least one extractor electrode.

20. The electron beam exposure apparatus according to claim 19, wherein said extractor electrode is a planar extractor electrode.

21. The electron source exposure apparatus of claim 20, wherein said extractor electrode is located after said space charged region and provided with a positive voltage for inducing a negative lens effect to said electron beamlets.

22. The electron beam exposure apparatus of claim 21, wherein said source is adapted for generating an electron beam, and said beamlet generator furthermore comprises a beamsplitter for splitting said electron beam up into said plurality of beamlets.

23. The electron beam exposure apparatus of claim 21, wherein said positive voltage is set at a predefined value for creating a negative lens effect for the emitted electron beam.

24. The electron beam exposure apparatus according to claim 1, wherein said beamlet generator comprises a source for emitting at least one electron beam, at least one beamsplitter for splitting said at least one emitted electron beam into said plurality of electron beamlets, and an illumination system for transforming the electron beam, emitted by said source, into a collimated electron beam before it reaches said beamsplitter.

25. The electron beam exposure apparatus according to claim 1, wherein said modulator comprises a beamlet blanker array, wherein said beamlet blanker array comprises electrostatic deflectors.

26. The electron beam exposure apparatus according to claim 1, further comprising scanning deflection means, preferably provided between the modulation array and the

focusing electron optical system, for deflecting the electron beamlets to scan said target exposure surface.

27. The electron beam exposure apparatus according to claim 26, wherein said scanning deflection means comprises electrostatic scan deflectors.

28. The electron beam exposure apparatus according to claim 27, further provided with actuators for moving said electrostatic scan deflectors and said target holder relatively to each other in the plane of the surface onto which the pattern is to be transferred in a direction that differs from the direction of the deflection performed by said electrostatic scan deflectors.

29. The electron beam exposure apparatus according to claim 28, wherein said controller comprises a timeshifter for shifting a timing base of said scanning deflection means and of said actuators with respect to each other.

30. The electron beam exposure apparatus according to claims 29, furthermore comprising an additional aperture plate between the modulation array and the focussing electron optical system, the additional aperture plate having one surface directed to and substantially parallel to the exposure surface of the target, wherein said electrostatic scan deflectors are conducting strips deposited on the side of the additional aperture plate facing the exposure surface of the target.

31. An electron beam exposure apparatus for transferring a pattern onto the surface of a target, comprising:

- a beamlet generator for generating a plurality of electron beamlets;
- a modulation array for receiving said plurality of electron beamlets, comprising a plurality of modulators for modulating the intensity of an electron beamlet;
- a controller, operationally connected to the modulation array, for individually controlling the modulators using control signals;
- a focusing electron optical system comprising an array of electrostatic lenses wherein each lens focuses a corresponding individual beamlet, which is

transmitted by said modulation array, to a cross section smaller than 300 nm, and

- a target holder for holding a target with its exposure surface onto which the pattern is to be transferred in the first focal plane of the focusing electron optical system,

wherein said beamlet generator comprises at least one thermionic source, said source comprising at least one extractor electrode adapted for being operated in a space charge limited region, said source adapted for generating an electron beam, and said beamlet generator furthermore provided with a beamsplitter for splitting said electron beam up into a plurality of electron beamlets.

32. The electron beam exposure apparatus of claim 31, wherein said extractor electrode is located after said space charge region and is provided with a positive voltage for inducing a negative lens effect to said electron beam.

33. An electron beam generator for generating a plurality of electron beamlets, wherein said beamlet generator comprises at least one thermionic source, said source comprising at least one extractor electrode adapted for being operated in a space charge limited region, said source adapted for generating an electron beam, and said beamlet generator furthermore provided with a beamsplitter for splitting said electron beam up into a plurality of electron beamlets.

34. A method for transferring a pattern onto a target exposure surface with an electron beam, using an electron beam exposure apparatus according to any one of the preceding claims.

35. A process wherein an electron beam exposure apparatus according to any one of the preceding claims is used for transferring a pattern onto a wafer.

36. An electron beam exposure apparatus for transferring a pattern onto the surface of a target, comprising a beamlet generator for generating a plurality of electron beamlets, a plurality of modulators for modulating each electron beamlet, and a controller for

providing each modulator with a control signal, said control signal having a timing base, wherein the controller is adapted for individually adjusting the timing base of a control signal with respect to the other control signals.

-o-o-o-o-o-o-o-o-

PvE